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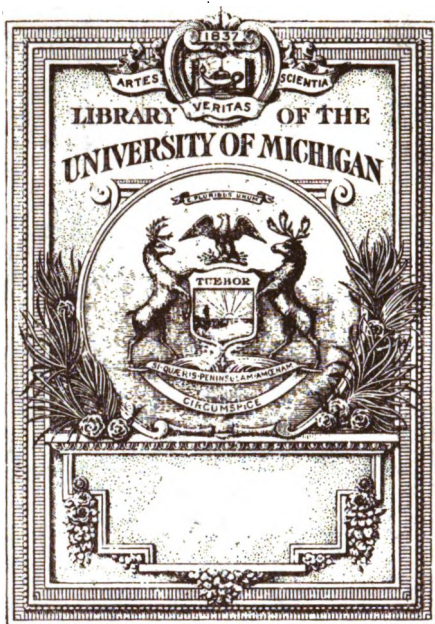
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GRANTHAM'S *John, 1809-18*

# STEAM CAR

FOR

## TRAMWAYS.



WATSON AND HAZELL, PRINTERS,  
LONDON & AYLESBURY.

—  
1874.

TJ  
705  
1676

100

WATSON AND HAZELL,  
PRINTERS,  
28, CHARLES STREET, HATTON GARDEN.

# STREET RAILWAYS.

## NO MONOPOLY.

CAN IT BE TRUE that the highways and byeways of our metropolis, and of every provincial town, are to be handed over to Signor Salamanca, a Spanish capitalist, represented in this country by Messrs. Heywood, Kennard & Company, the Bankers, and Mr. George Francis Train?

CAN IT BE TRUE that Mr. George Francis Train, who has introduced nothing either novel or good, boasts that, if he obtains his Permissive Bill, he will sell his concession for each parish as soon as his rails are laid?

CAN IT BE TRUE that Mr. George Francis Train boasts that he can buy our Members of both Houses, municipal authorities, and vestry-men, like a flock of sheep, as he knows what Britishers are made of?

CAN IT BE TRUE that Mr. George Francis Train appointed Mr. Abraham the Architect to his contemplated Central Metropolitan Hotel Scheme, to secure in his interest our Attorney-General; and is this the reason why the Attorney-General refused to certify to the nuisance in Victoria Street, so as to enable parties interested to appeal to Chancery?

CAN IT BE TRUE that Mr. John Bethell, the Attorney-General's brother, supplies the creosoted timber for Mr. Train's illegal tramways?

CAN IT BE TRUE that the honourable member for Newport supports this scheme, and that three of his sons are partners in it?

COULD NOT Messrs. Train and Salamanca have contracted with the Commissioners for our intended International Exhibition, whereby Barnum might have been induced to assist them? We then could have had an international cockpit, and dog-fights, turtle lunches, and champagne breakfasts, until the bill was sent in. *It might pay.*

CAN IT BE TRUE that Mr. George Francis Train has promised Barnum the concession of the Tramway he is about to lay from my humble handle, if he will come over and help him to humbug the vestries of this immaculate city?

CAN IT BE REALLY TRUE that Mr. Train has issued cards for another grand breakfast, to Members of Parliament and others, for Monday morning, at the Westminster Palace Hotel? and is the House becoming a saleable commodity?

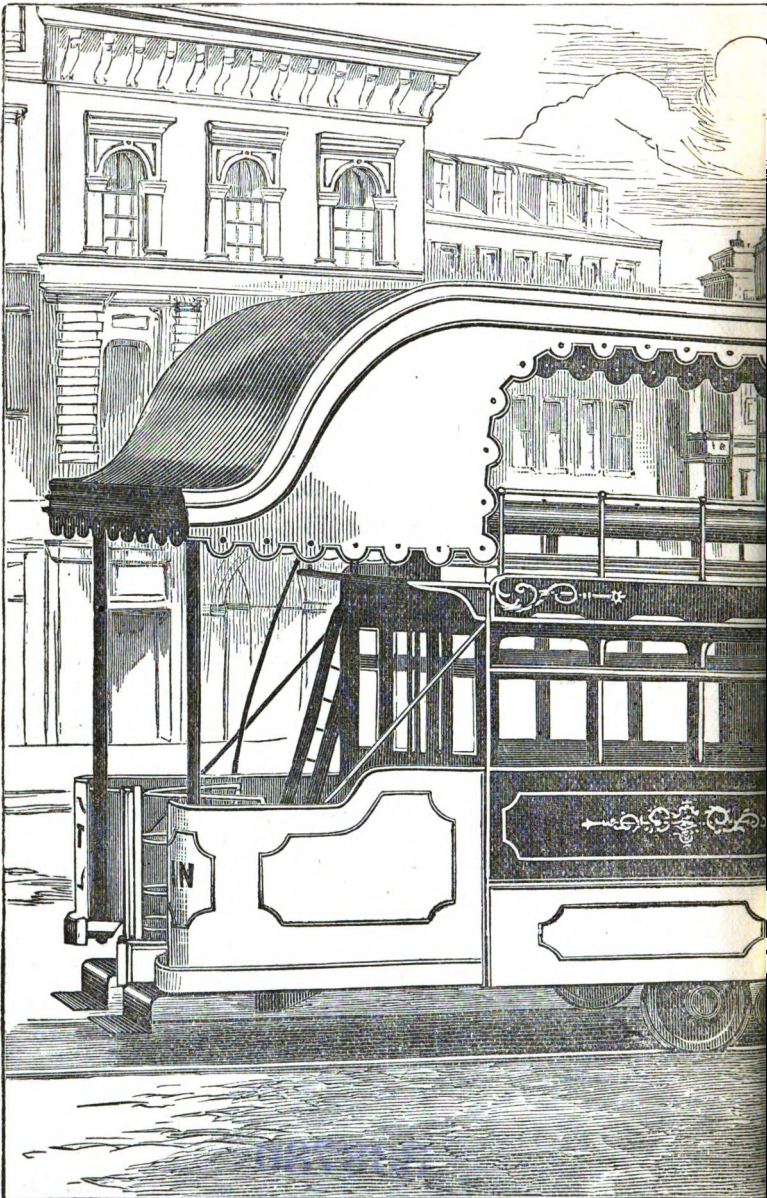
CAN IT BE TRUE that Englishmen are to be bought over by turtle lunches and champagne breakfasts? If so, our International Exhibition job, our Atlantic cable, our "Great Eastern," our Metropolitan Railway, our Iron-cased Men-of-War, sink into insignificance.

Any Member of the House of Commons who attends Mr. Train's Champagne breakfast on Monday morning, is requested to forward full particulars, with a list of the Irish Members present, to the address below, and I will endeavour to purify them.

OLD ENGLAND'S GHOST.

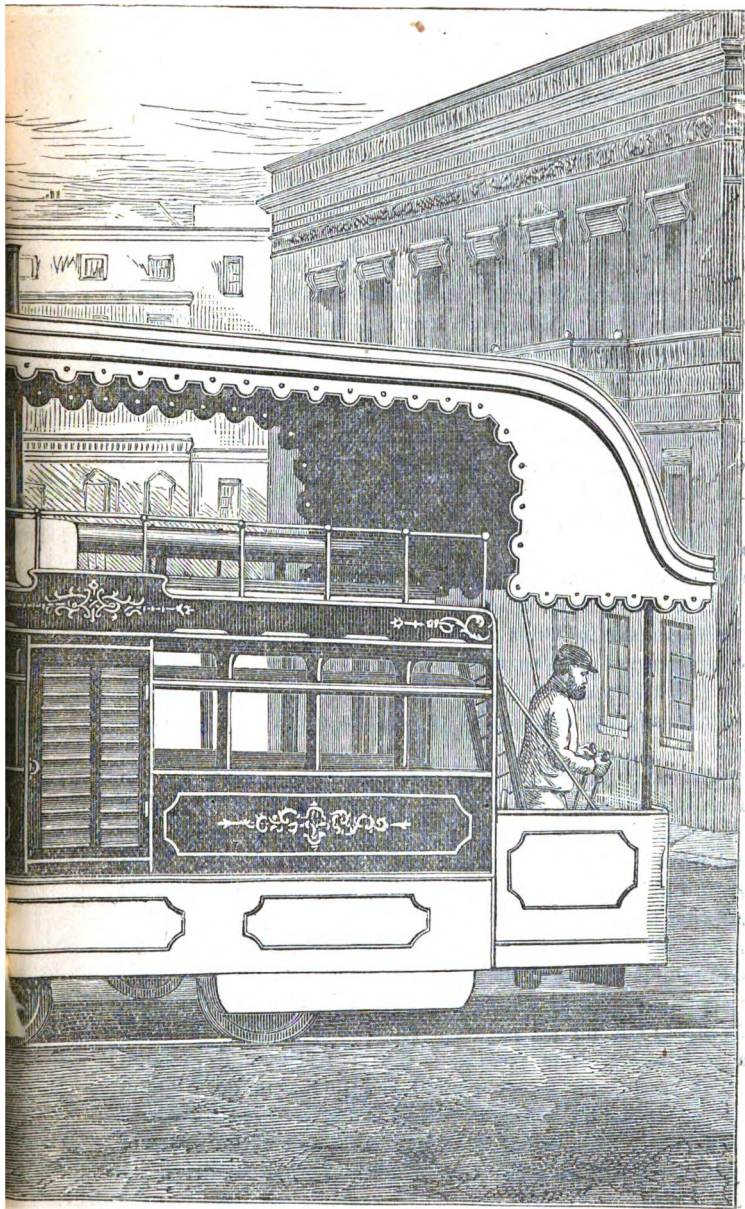
ALDGATE PUMP,  
13th April, 1861.

# GRANTHAM'S STEAM





R FOR TRAMWAYS.



## PREFACE.

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THE following brief description of the patent steam car has been written with the view of conveying to those interested a general idea of the plan that has been adopted, of the performance of the car, of the improvements that have been suggested during the course of the work, and which improvements are now being carried out. It is admitted that this steam car meets the requirements so long sought for, in providing a safe and economical mode of substituting steam for horse power on Tramways, while it opens out the prospect of a great extension of the system, and of light branch Railways on our public roads, as feeders to the existing main lines.

But a great anomaly exists in the present position of this question. England, it is believed, is the only country in the world where the use of steam for this object is *prohibited by law*. In all other countries the power to permit or forbid the use of steam in their streets and highways is vested in the local authorities, who can withdraw all restrictions when its safe adoption is ensured, and this is now being done in some countries avowedly to encourage the use of steam. While in England, the centre of mechanical skill, the promoter of the steam engine in all its varied forms, with steam power adapted to every branch of industry in which horse or manual power were employed—in England it is illegal to use steam power on our highways for the conveyance of passengers and goods; even though it is now shown that it can be done with perfect safety and comfort, and would if used confer a great commercial as well as social benefit to the community.

Our legislators are not asked to withdraw all restrictions to the use of steam on our highways; it is felt that in this, as in other similar cases, a controlling power should be named, which should decide what might and what might not be used; and when as it is now shown that a great public benefit is to be derived from the employment of steam, and that the great suffering to horses can be avoided, the law should no longer forbid its use. It may be said that the law does not absolutely prohibit the use of the steam engine on the roads, as with certain restrictions steam carriages may be worked at a *slow speed* and *during the night*; but for all purposes of passenger traffic this is of course a prohibition. The ponderous steam rollers and traction engines that have been hitherto employed doubtless do frighten horses, but the plans to which attention is drawn have entirely removed these objections, and supply an agreeable and cheap mode of travelling that will prove a great boon in this and other countries.



## Grantham's Steam Car for Tramways.

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IN addressing myself to the task of improving the system of tramways, I may briefly state my experience in their construction and working.

First, while resident in Liverpool, I had frequent opportunities of witnessing the effect of the Birkenhead tramway, the first line laid down in England upon the American system. Secondly, I was engineer to a railway in South America, which had a short tramway in communication with it; and thirdly, I was engineer to the Copenhagen tramway, one very difficult of construction. This I personally laid out some years ago. It has since then been much extended, and is a very profitable undertaking.

Added to this, my practical knowledge of the steam-engine in all its forms made me confident that we were approaching the time when steam could be applied to tramways as a substitute for horses. Such a step was to be accomplished by the combination of the various improvements which the universal employment of small steam-engines has of late years brought into operation, and only requiring some one conversant with the subject to render them applicable to the use of the modern tramway system.

This has now been done, and it requires but little foresight to be assured that the greater part of our road traffic will be carried on iron rails, and that in all such cases the propelling power will be steam.

In making this confident prediction I do not underrate the difficulties of the case, but I know also that our greatest difficulty arises from objections that have no real foundation; these, as usual, will be best overcome by time; fortunately for us who are dealing with the subject, we have also the counteracting influence of *urgent necessity* to help us. Traction by horses cannot long be maintained for reasons which are too well understood by managers of tramways.

When commencing the experimental car which is now at work I promised those who joined me that the noise of the engines would be so reduced as to be below a nuisance, that the comfort

of passengers would not be interfered with, and that the car would be perfectly manageable. All this has been more than realised.

There is at present a wide gap between railways and tramways that must be filled up; this can only be accomplished by the extended use of the steam-engine. The railway system has for many years asserted its supremacy for the long and heavy traffic of this and many other countries. Its use is only limited by the cost of construction and of working; but these are *very large*, and can only be incurred where the traffic is large also.

Again, the tramways are being rapidly introduced as a substitute for omnibuses in the ordinary streets and in the suburbs of our populous towns, and the comfort and convenience of them is beyond all doubt; but there are also limitations here. The *horse* question is becoming daily more serious. If the distances are great and the inclines severe, the number of horses and the cost of working them is so great that the ordinary confined, uncomfortable omnibus can still hold its ground, and in the conveyance of light goods to and from places where railways would be too costly, the old road carrier is still the only channel.

The use of steam on tramways, and the more general introduction of light rails on our public roads, will probably supply the "missing link."

Those who have given their attention to the working of tramways in our public thoroughfares are aware that certain features are absolutely essential in the adoption of steam cars. They must work in both directions without requiring to be turned. As now used, the horses are moved at great inconvenience from one end to the other at every terminus, and the driver and conductor change places.

Again, the public enter and leave the car at that end which is for the time the back. There must, in consequence, be a passage through it from end to end.

There must also be the most perfect command over the motion of the car; to start easily, so as not to lose too much time, and to stop quickly, to lessen the risk of collisions and other accidents.

In carrying out the practical details of a tram car it will be observed that a short wheel base is required to enable it freely to pass the curves, while the car itself must be of great length to accommodate a sufficient number of passengers. This involves the necessity of placing the weight of the machinery in the centre.

Steam cars having the machinery at the ends have been tried, but the arrangement is destructive of all the requirements above described.

A long wheel base, however, has its advantages in keeping the car steady. To accomplish this, and still to ease the motion at the sharp curves, I have adopted the Bogie system, now prevalent on many railways. This arrangement has also important advantages of another kind. By a simple addition to the Bogie frame I have been able to introduce a plan for guiding the car, so that no moveable switches are required at the sidings—a point of great importance on tramways. It also gives me the power to leave the rails when an obstruction occurs, or to get on to them again when the car is accidentally thrown off.

The experimental car has cylinders of 4 in. diameter and 10 in. stroke working direct to the driving wheels. This is found amply sufficient for all ordinary work, but to ensure sufficient power for extraordinary occasions, and to have a large surplus at starting, I have now adopted cylinders of 6 in. diameter which more than double the power, but as the steam valves are arranged no increase is made in the consumption of fuel. I have found also that instead of two boilers, as in the present car, I can apply one only, and still preserve the internal arrangement of the car as above described.

It will be seen that the steam cars thus constructed, of which drawings are annexed, meet all the above requirements, while no inconvenience is felt by the passengers, and no danger incurred by the public. But this is not all. Before we can claim entire success it must be proved that there is also a *commercial* advantage to be gained by the reduced cost at which steam can be introduced as a substitute for horses. This is now shown to be effected, affording at the same time the opportunity to introduce many other improvements.

It is calculated that with the time saved in stopping and starting, and the slightly increased speed when the road is clear, each car will be able to perform a greater number of journeys in the day. Where the traffic is large, the steam car will also admit of an increase in the number of passengers; the plan No. 3 is designed to carry 60 persons.

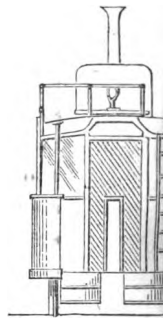
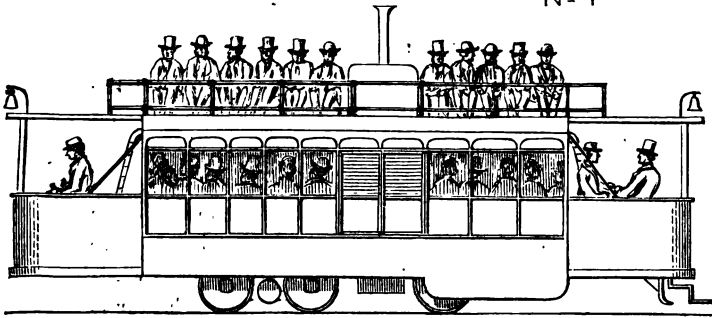
The various propositions for employing traction engines are quite inadmissible for street traffic, and all plans for the employ-

# GRANTHAM'S STEAM

ELEVATION

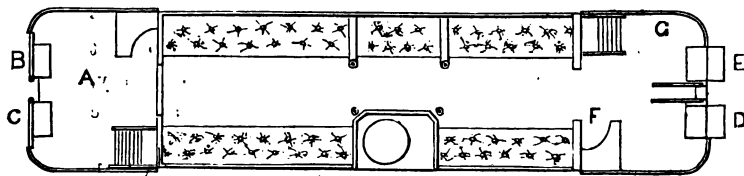
Nº 1

END VIEW



CROSS SECT

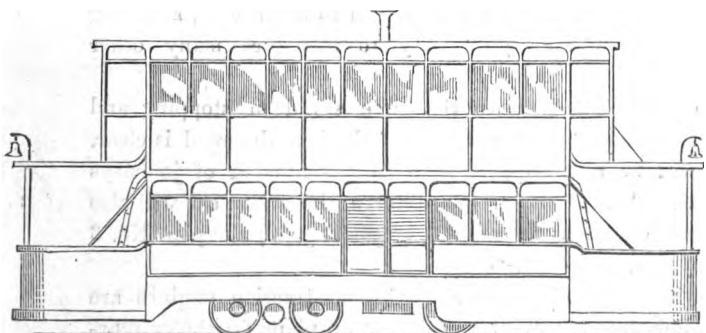
PLAN IN SECTION



Nº 2

ELEVATION

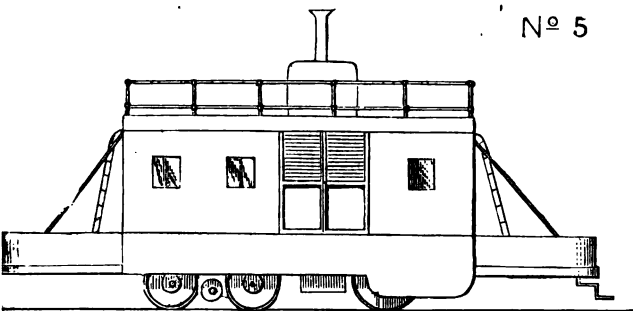
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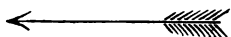
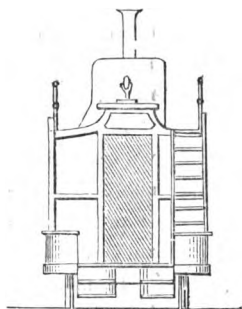
# R FOR TRAMWAYS.

ELEVATION

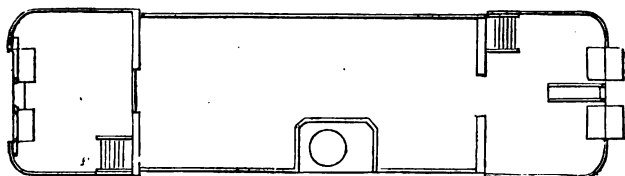
Nº 5



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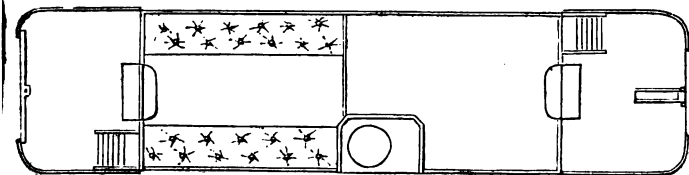


PLAN



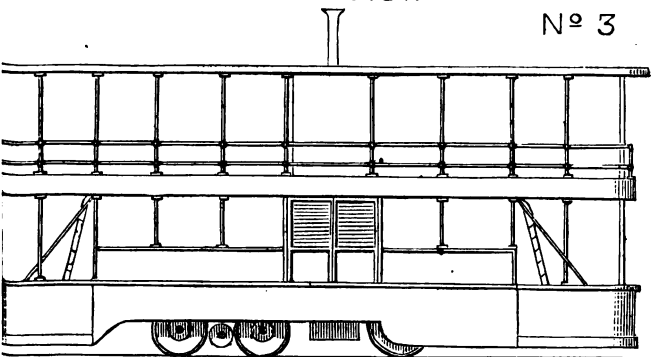
PLAN

Nº 4

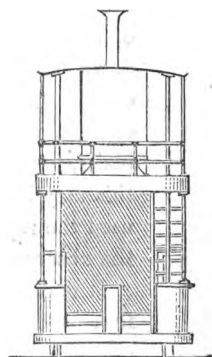


ELEVATION

Nº 3



END VIEW



ment of compressed air or for gas engines, which have been at various times suggested as a motive power for tram cars, have been well considered, and are found to have disadvantages of a serious nature, and have consequently not met with encouragement.

An improved method of collecting the fares can also be adopted, which will assimilate to the railway system ; and various plans for sheltering the outside passengers may also be introduced. These improvements cannot be obtained where horses alone are used, as they entail some additional weight and wind draught.

It is a narrow view to suppose that improved tramways will interfere with railways. It may fairly be expected that they will become feeders rather than rivals. In some localities their interests may clash, but the reverse will be the rule.

Extended as is the net of the railways that now intersects this country, many small towns and villages are suffering for want of them, and are being left behind in the rapidly-increasing facilities which large towns, and even small ones, which happen to be in the railway routes, are receiving.

The costly railway and its heavy engines and plant require a traffic which few small towns or villages can support, while the horse omnibus and carrier's cart, over rough roads, are the only means of communication for the people.

It will be seen by the estimates which are given below what may be expected from the use of light tramways worked by steam.

We have first to consider the cost of tramways in large towns. This is much greater than in the country, owing to the amount of new pavement, and the necessity for a much firmer foundation for the rails. The number of cars and horses, and the great expense of stabling, form heavy items, so that the first cost may be set down at £10,000 per mile, and in many cases this has been exceeded. In the country, however, where a single line is sufficient, a tramway of the average length of five miles, with its plant, need not exceed £3,000 per mile, and in some cases even this may be reduced ; and it may be noticed that where steam is used the repairs of the roads will be lessened, in consequence of the absence of wear from the horses' feet.

It is difficult in this early stage of our work to estimate the first cost of a steam-car ; but it may be safely calculated not to exceed the cost of the present car and its complement of horses.



The working expenses will in a great measure depend on the locality and the distance run each day. A London tramway car at present requires 10 to 12 horses, and as each horse costs about £60 per annum, the total expense of horses alone is from £600 to £700, independent of the wages of the driver, conductor, and of the car itself.

By using steam-engines as substitutes for horses our experiments with the present car show the following results :—To work the car for 14 hours requires 5 cwt. of coke and coal mixed, which, at the average cost of fuel in various places, will amount to 5s. to 7s. 6d. a-day ; add to this the extra wages to the engine-driver, the wear and tear, and sundries, about equal to the cost of fuel, and we have an annual expenditure of about £300, or a saving of about £300 for each car.

To this may be added the advantage of one or two additional journeys, and greater satisfaction to the public.

It has been stated above that the use of steam gives rise to an improved method of receiving fares. This has long been a question of grave consideration with the proprietors of omnibuses, but is one of much more serious consideration on tramways, and various plan have been patented and tried as a check. The most elaborate, perhaps, is that on the tramway between Paris and Versailles and St. Cloud. It is unnecessary here to describe any of these plans, as with the utmost consideration their entire disuse on many tramways shows that no confidence is placed in them. A check is required for two reasons : First, it is notorious that the conductors in many cases do not return all the money they receive. Thus the companies suffer, and even the honest men are suspected. Secondly, as the fares in general vary on the same route according to distance, and the number of passengers passing in and out at all parts is large, it is quite impossible for the conductors to know, by the system adopted, whether the correct amount has been paid by each. The only system that can be an effectual check in these cases is that adopted by the railways, viz., to pay on entering and to receive tickets that will indicate the distance paid for, so that if the passenger on leaving and giving up his ticket is seen to have overshot his distance he is required to pay the excess. To work this system out fairly two men are required instead of one ; but as the check will be very effectual, one at least of these may be a youth at low wages, while the saving to the company will be great.

But, still further, suppose it is seen that the whole available space on the top of the car may be used, and, as stated above, an increased number of passengers may be provided for, the necessity for an efficient system of collecting fares is still more evident.

The advantages resulting from the use of steam on tramways in crowded streets may be summed up as follows :

1st. A saving of £300 to £400 per annum in the working expenses of each car.

2nd. Time saved in the stopping and starting, and the ingress and egress of passengers.

3rd. An increase in the number of passengers owing to the increased speed.

4th. A more effectual competition with horse omnibuses.

5th. The adoption of better shelter for outside passengers.

When viewed in relation to the application of tramways in provincial towns the advantages above enumerated will be more or less realised, but it will afford :—

1st. The additional advantage of introducing a modified railway system to places where the present costly railway will not pay, and in many cases to become feeders to railways.

2nd. It will utilize the present high roads, which in many places have only a small traffic.

3rd. It will save the wear on the roads, and reduce the cost of maintenance.

4th. Passengers and light goods can be conveyed in the same car.

5th. It will be a more agreeable mode of travelling, and much add to the facilities of locomotion.

It is thus expected that we are on the eve of a great increase in the facility and comfort of travelling, in circumstances where by the present means the utmost limits have been nearly reached.

It now only remains for me to describe the various plans for cars as represented in the engraving. No. 1, with elevation, plan, end view, and section, is the car recommended for use in our crowded towns. It would accommodate about 44 passengers, and has platforms at each end, where, if required, the proposed system of collecting fares can be adopted. Referring to this plan, and supposing it to be running in the direction of the arrow, A is the position of the engine-driver, who works the

handles that control the engines and feed the fires. Water and steam gauges are placed at each end of the car where the engine-driver can see them. The gates at B and C are closed, and the passengers enter at the point D, and leave at E; at F the man stands who collects fares and gives tickets, and at G is the youth who receives them as the passengers leave.

The machinery is placed in the centre of the car, while the lever-handles for working the valves and feeding the fires extend to the end platforms, where the engine-driver stands, as above stated.

When the car has reached a terminus the gates at B and C are thrown open, the engine-driver and the conductor change places, and the gates at D and E are closed.

The proposed system of taking the fares need not be adopted if any other is preferred, as its omission does not affect the form of the car.

No. 2 is the elevation and end view of the same car, having an awning or a light upper story to protect the passengers.

No. 3 is the elevation and end view of a car designed for India or other hot countries where the roof is made available for passengers for its whole length, accommodating about 60 in all; this car would be light, and have canvas curtains instead of glass.

No. 4 is the plan only of a car for country places, when a few passengers and light goods are to be carried.

No. 5 is the elevation and end view of the design for a truck required for goods only, having but one man to work it. I think it will be found best generally to let each car have its own engines. It will, of course, be practicable to take trucks in connection with passenger cars, but in towns this may not be found desirable.

As experience is gained modifications of the present plans will no doubt be made, but these give a good idea of what is practicable.

JOHN GRANTHAM, M. Inst. C.E.

17, *King's Arms Yard, London.*

AUG 21 1919

